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Digestate as nutrient source for biomass production of sida, lucerne and maize

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Biogas as a renewable energy source is supported in many countries driven by climate and energy policies. Nowadays, Germany is the largest biogas producer in the European Union. A sustainable resource management has to be considered within this growing scenario of biogas production systems and its environmental impacts. In this respect, studies aiming to enhance the management of biogas residues, which represents a valuable source of nutrients and organic fertilization, are needed. Our objective was to evaluate the digestate (biogas residue after fermentation process) application as nutrient source for biomass production of three different plants: sida (Sida hermaphrodita - Malvaceae), lucerne (Medicago sativa - Fabaceae) and maize (Zea mays – Poaceae). The digestate was collected from an operating biogas facility (fermenter volume 2500m^3, ADRW Natur Power GmbH & Co.KG Titz/Ameln, Germany) composed of maize silage as the major feedstock, and minor amounts of chicken manure, with a composition of 3,29% N; 1,07% P; 3,42% K; and 41,2% C. An arable field soil (Endogleyic Stagnosol) was collected from 0-30 cm depth and 5 mm sieved. The fertilizer treatments of the plants were established in five replicates including digestate (application amount equivalent to 40 t ha-1) and NPK fertilizer (application amount equivalent to 200:100:300 kg ha-1) applications, according to the recommended agricultural doses, and a control (no fertilizer application). The digestate and the NPK fertilizer were thoroughly mixed with the soil in a rotatory shaker for 30 min. The 1L pots were filled with the fertilized soil and the seedlings were transplanted and grown for 30 days under greenhouse conditions (16 h day/8 h night: 24ºC/18ºC; 60% air humidity). After harvesting, the leaf area was immediately measured, and the roots were washed to allow above and below-ground biomass determination. Subsequently, shoots and roots were dried at 60ºC for 48 hours. The biomass and leaf area of sida, lucerne and maize presented similar performance for both digestate and the NPK fertilizer applications, which were greater than the control, showing a positive fertilizing effect of the digestate for plant biomass production. Considering the biomass production obtained with the digestate application for sida, lucerne and maize, the results give support for further field experiments which aim to evaluate the fertilizing and conditioning effect of digestates.